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# USATHAMA

U.S. Army Toxic and Hazardous Materials Agency  
Report of Sampling and  
Analysis Results

Midway Army Housing Units  
Kent, Washington

August 1990

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Prepared for:

U.S. Army Toxic and Hazardous Materials Agency  
Aberdeen Proving Ground  
Maryland 21010-5401

Prepared by:

**WESTON**  
MANAGERS DESIGNERS CONSULTANTS

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## REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION / AVAILABILITY OF REPORT Distribution Unlimited		
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S)			5. MONITORING ORGANIZATION REPORT NUMBER(S) CETHA-BC-CR-90105		
6a. NAME OF PERFORMING ORGANIZATION ROY F. WESTON, INC.		6b. OFFICE SYMBOL (If applicable)		7a. NAME OF MONITORING ORGANIZATION Environmental Assessment & Information Sciences Division Argonne National Laboratory (for USATHAMA)	
6c. ADDRESS (City, State, and ZIP Code) Roy F. Weston, Inc. Weston Way West Chester, PA 19380				7b. ADDRESS (City, State, and ZIP Code) Argonne National Laboratory 9700 S. Cass Avenue Argonne, IL 60439	
8a. NAME OF FUNDING / SPONSORING ORGANIZATION U.S. Army Toxic & Hazardous Materials Agency		8b. OFFICE SYMBOL (If applicable) CETHA-BC		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER U.S. Department of Energy Contract W-31-109-ENG-38	
8c. ADDRESS (City, State, and ZIP Code) U.S. Toxic & Hazardous Materials Agency Attn: CETHA-BC Aberdeen Proving Ground, MD 21010-5401		10. SOURCE OF FUNDING NUMBERS			
		PROGRAM ELEMENT NO.		PROJECT NO.	TASK NO.
					WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) UNCLASSIFIED Report of Sampling and Analysis Results: Midway Army Housing Units Kent, Washington					
12. PERSONAL AUTHOR(S)					
13a. TYPE OF REPORT Final		13b. TIME COVERED FROM _____ TO _____		14. DATE OF REPORT (Year, Month, Day) August 1990	
15. PAGE COUNT					
16. SUPPLEMENTARY NOTATION Prepared for the U.S. Army Toxic & Hazardous Materials Agency by Roy F. Weston under a contract from, and the supervision of Argonne National Laboratory					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP			
19. ABSTRACT (Continue on reverse if necessary and identify by block number)  Roy F. Weston, Inc. has conducted a sampling and analysis program of the Army housing property located in Kent, Washington. The objectives of this effort include further characterization of environmental contamination identified in an enhanced preliminary assessment carried out in 1989. The specific activities performed at this site were identification, evaluation of the condition, and collection of samples from specific suspected asbestos-containing materials, including floor tiles, pipe run and pipe fitting insulation, dust in the ductwork, and exterior siding, where present. These evaluations were necessary to clarify potential environmental issues identified in the earlier report, prior to the sale or realignment of the property.					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL Joseph Ricci			22b. TELEPHONE (Include Area Code) (301) 671-3461		22c. OFFICE SYMBOL CETHA-BC

**SAMPLING AND ANALYSIS AT THE U.S. ARMY  
FAMILY HOUSING UNIT (FHU) PROPERTY  
KENT, WASHINGTON**

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## EXECUTIVE SUMMARY

The U.S. Army family housing units (FHUs) at Kent, Washington were inspected by Roy F. Weston, Inc. (WESTON) personnel during February 1990 to further evaluate the environmental concerns identified in the enhanced Preliminary Assessment reports prepared and submitted earlier by Argonne National Laboratory (ANL) for the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). Three of the 32 single-family "Capehart" housing units were examined on 20 February to investigate the possible presence of asbestos-containing materials (ACM). An assessment of airborne asbestos exposure was performed at one unit on this property on 12 April 1990 by a WESTON Certified Industrial Hygienist (CIH), because asbestos fibers were detected in the dust deposited within the ductwork of the heating system.

The ANL Draft Sampling and Analysis Plan, Revision 1 (SAP) specified sampling the following materials, where present, which are suspected to contain asbestos, from ten per cent of the housing units or a minimum of three, whichever is greater.

- Pipe run insulation.
- Dust accumulated inside heating ductwork within the concrete slab, where present and open.
- Vinyl floor tiles.

The WESTON personnel selected three housing units for inspection after review of maintenance records and drawings, discussions with housing management personnel, and determination that the units were in similar condition. The housing units chosen, Nos. M-06, M-10, and M-21, were considered to be representative of the other 29 units, but this was not confirmed by an examination of all the units.

Twelve dust samples, and eight samples of floor tile and vinyl sheeting were collected by WESTON and analyzed. These analyses revealed that asbestos is present in dust accumulated within the heating ductwork and in floor tile and vinyl sheeting at the three housing units examined. Asbestos was found in all of the twelve dust samples by transmission electron microscopy (TEM), and in at least two samples from each unit. Asbestos was quantified at 10% or greater by polarized light microscopy (PLM) in four of the floor tile and vinyl sheeting samples, and was qualitatively identified in one other sample by TEM. Three additional floor covering samples were found to contain asbestos by PLM at less than 1%. No pipe insulation samples were collected since the pipes in the units examined were not insulated. During the sampling activities, other suspect materials which were noted in the units included granular spray-applied paint on ceilings and walls, furnace gaskets, and expansion joints on the heater units.

The following practices should be observed with regard to the known and suspected asbestos-containing materials identified:

- The risks posed by the asbestos-containing dust in the ductwork cannot be clearly evaluated, because the sampling and analysis program only included a qualitative screening of this material since no approved quantitative procedure exists. Further studies, such as air sampling, were recommended to determine if the asbestos is becoming airborne and to define what risks, if

any, are presented by these findings. These studies were subsequently performed and the findings are presented in this report.

- The vinyl floor coverings pose no significant risk as long as they are in good condition and are not damaged by excessive wear or misuse. They should be managed in place under an Operations and Maintenance (O&M) program which describes procedures for the regular inspection of the floor coverings and the removal and replacement of any that become damaged.
- Other suspect materials identified but not sampled, including spray-applied texture paint, furnace gaskets, and expansion joints, should be assumed to contain asbestos and managed in place under an O&M program until they are either removed or determined to contain no asbestos.

Samples for airborne asbestos were collected from four floor vents, one located in each of the living room, living room near the kitchen, bedroom 1, and bedroom 2, in an unoccupied unit which had not been inspected previously. As a consequence, dust samples were also collected from these vents. The air samples were subjected to analysis by TEM to identify and quantify any asbestos fibers collected. No asbestos fibers were found in any of the samples from this house. The sample volumes collected resulted in detection limits for airborne asbestos fiber concentration of <0.005 fibers per cubic centimeter (f/cc), which does not pose a substantial risk to occupants. The sampling procedures employed were designed to simulate the worst-case concentration that is likely to be encountered. Chrysotile fibers were detected in all of the four dust samples collected during this follow-up study.



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SECTION 1. INTRODUCTION

**SAMPLING AND ANALYSIS AT THE U.S. ARMY  
FAMILY HOUSING UNIT (FHU) PROPERTY  
KENT, WASHINGTON**

**SECTION 1. INTRODUCTION**

Roy F. Weston, Inc. (WESTON) was retained by Argonne National Laboratory (ANL) to provide assistance in gathering additional environmental data for the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) at 53 family housing unit (FHU) properties in 12 states. The Kent, Washington property is one of these FHUs.

**1.1 PURPOSE AND SCOPE**

The purpose of this project was to provide the Department of the Army with sound environmental data on the properties which are scheduled for sale or realignment as a result of the Defense Authorization Amendments and Base Closure and Realignment Act (Public Law 100-526). Environmental assessments of each property covered by the Act are required by the Secretary of Defense prior to their closure or realignment. Such actions must be performed in accordance with applicable provisions of the National Environmental Policy Act (NEPA) to ensure that any environmental hazards will be identified and mitigated where required.

Previously, ANL conducted enhanced preliminary assessments (PAs) for each property. These enhanced PAs made recommendations regarding sampling and analysis to determine (1) whether and in what quantities asbestos is present in certain building construction materials (including pipe run insulation, dust accumulated in heating ductwork, vinyl floor tile, and exterior siding shingles, where present), (2) in selected contexts, whether and in what concentration soils and groundwater may be contaminated, and (3) whether and in what range transformer oils at selected sites may contain polychlorinated biphenyls (PCBs). WESTON gathered this data by implementing ANL's Draft FHU Sampling and Analysis Plan, Revision 1 (SAP). Subsequent to the initial studies, WESTON, ANL, and USATHAMA decided that a follow-up effort was required to determine if asbestos fibers were becoming airborne from the dust in the heating system. This study was implemented, and samples were collected to evaluate any risks to occupants from this source.

**1.2 SITE DESCRIPTION**

The Department of the Army's FHU property in Kent, Washington consists of 32 single-family housing units located on 10.18 acres. The units are situated on a triangular-shaped piece of property bound by Jeffery Road to the north, Military Road to the east, and South 240th Street to the south.

The three-bedroom "Capehart"-style single-family housing units were constructed in 1958. The single-story, wood-frame units were built on concrete slab foundations with no basements or crawl spaces. The ducts for the original heating system and domestic water lines were embedded in the concrete slab, which was covered with vinyl floor covering. The units have pitched roofs surfaced with asphalt shingles and exteriors finished with vinyl siding.



### 1.3 REPORT ORGANIZATION

This report contains the results of the sampling and analysis program performed by WESTON. Section 2 contains a description of the asbestos sampling performed at the property and laboratory results for samples of suspected asbestos-containing material (ACM) collected. Copies of field notes and laboratory results pertaining to asbestos are provided in Appendices A.1 and A.2. Section 3 presents a description of the field sampling activities and results of the analyses for airborne asbestos fibers. Field notes and copies of the laboratory reports for this effort are presented in Appendices B.1 and B.2, respectively. Section 4 is a summation of all activities and findings for Midway.

SECTION 2. ASBESTOS-CONTAINING MATERIALS

## SECTION 2. ASBESTOS-CONTAINING MATERIALS

WESTON personnel inspected three of the 32 "Capehart" units at the Kent family housing facility on 20 February 1990 for the presence of suspected ACM. Vinyl floor tile, vinyl sheeting, and dust accumulated within the heating ductwork were the only suspect materials found within the buildings that were sampled. All sampling was done following the requirements of ANL's SAP. Additionally, all field work was performed in accordance with applicable Federal regulations, including 40 CFR Part 61 Subpart M, 40 CFR Part 763 Subpart E, and 29 CFR Part 1910.1001.

### 2.1 SAMPLING RATIONALE

The sampling rationale used by WESTON for this project followed the recommendations set forth by ANL. The type of suspect ACM to be sampled, the number of housing units to be examined at each FHU facility, and number of samples to be taken for each material found were described in the SAP. The plan for Kent required sampling of the following materials, if present:

- Pipe run insulation.
- Accumulated dust inside heating ductwork if not sealed.
- Vinyl floor tiles.

In accordance with the SAP, three units were examined at this facility. The sampling plan, however, did not identify specific units which were to be sampled. The task of determining which housing units were representative of the facility as a whole and, therefore, would be sampled was left to the WESTON field team. After reviewing all available maintenance records and drawings and discussing the facility with Directorate of Engineering and Housing (DEH) personnel, it was determined that all of the units at the Kent FHU were similar in condition. Units M-06, M-10, and M-21 were chosen by the WESTON field team leader as representative units to be sampled.

The SAP specifies that a minimum of two pipe run insulation samples, four dust samples, and one sample of each color of floor tile be collected from each of the housing units examined. Twelve dust samples and eight samples of vinyl floor coverings were collected at the facility. No pipe insulation samples were collected since the pipes in the units examined were not insulated.

### 2.2 FIELD ACTIVITIES AND OBSERVATIONS

Each of the units was inspected to determine if suspect materials were present. Heating ductwork vents in the units were not sealed, so dust samples were collected by wiping the inner surface of the duct near the designated exhaust vents with a fiber-free wipe selected for its ability to trap dust in a non-fibrous matrix. Each wipe was placed in the jaws of a flexible small parts pick-up tool and moistened with fiber free water. The grille was then removed and the tool inserted into the duct opening. The interior surface was wiped to collect dust on the moistened surface of the wipe. After the dust was gathered, the wipe was placed in a small plastic wide-mouth jar, sealed, labeled with the sample number, and shipped to the lab. The grille was then replaced and the tool was cleaned by rinsing and wet wiping the surfaces prior to collecting the next sample. Samples were collected from the living room, hall, bedroom, and main bathroom in all three units.

Two colors (green and brown) of 9" x 9" vinyl floor tile, one color (tan) of 12" x 12" vinyl floor tile, and one color (light green) vinyl sheeting were sampled. All three units contain tan 12" x 12" floor tile and light green vinyl sheeting. Unit M-10 also contained both green and brown 9" x 9" floor tile. One sample of each of the floor tile and vinyl sheeting types was taken in each housing unit, resulting in a total of eight samples for laboratory determination of asbestos content. These samples were taken by breaking off a small piece of floor covering in an inconspicuous location. About one square inch of the tile surface area was taken for each sample. No effort was made to separate the mastic, which sometimes contains asbestos, from the floor tile samples themselves.

The vinyl floor coverings in all three of the units inspected was in good condition. This material is considered to be a non-friable type of ACM, unless damaged. If significant damage occurs, such that the material becomes friable as defined in the asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP), the U. S. Environmental Protection Agency (EPA) would classify these tiles as friable materials. However, an EPA interpretation was recently released that changes certain previous interpretations regarding non-friable ACM. On 23 February 1990, a memorandum was issued by the Director of Emissions Standards Division, the Director of Stationary Source Compliance Division, and the Associate Enforcement Counsel for Air Enforcement of the EPA Office of Air Quality Planning and Standards (OAQPS). This memorandum was circulated to other air quality officials and EPA regional offices in early March 1990. This latest position states that floor tiles and certain other non-friable materials do not have to be removed from a facility prior to demolition, unless they are severely damaged and thus are considered friable, or unless the demolition may cause fiber release through grinding or abrasion of the tiles. Floor tile removal shall be done if demolition is to be accomplished by burning, either of the unit or of the debris from demolition. However, if the floors in the housing units are to be renovated, special care must be taken during the process to prevent the release of asbestos fibers.

The WESTON field team was directed, as a part of the project scope contained in the SAP, to perform sampling and analysis of specific suspect ACM. Other suspect materials observed were granular spray-applied paint on ceilings and walls, furnace gaskets, and expansion joints on the heating units. Copies of the field notes are included in Appendix A.1.

### **2.3 LABORATORY PROCEDURES AND RESULTS**

The bulk samples of building materials were analyzed for asbestos content by WESTON's optical microscopy laboratory in Auburn, Alabama. This laboratory is accredited by the American Industrial Hygiene Association (AIHA) and the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). The bulk samples were analyzed by Polarized Light Microscopy (PLM) using the EPA's "Interim Method for the Determination of Asbestos in Bulk Insulation Samples", EPA 600/M4-82-020, December 1982. Copies of the laboratory reports are included in Appendix A.2.

Vinyl floor covering samples for which no asbestos was found using PLM methods and wipe samples of dust accumulated within heating ductwork were analyzed qualitatively for the presence of asbestos by Transmission Electron Microscopy (TEM) at WESTON's NVLAP accredited electron microscopy laboratory in Auburn, Alabama. Copies of these laboratory reports are also included in Appendix A.2.

All analyses were performed in accordance with protocols set forth in the Laboratory Accreditation package submitted by WESTON under NVLAP. This document includes standard procedures for sample analysis and quality assurance / quality control (QA/QC) which were acceptable to NIST. The QA/QC protocols for the laboratory differ significantly from those commonly found in chemical analysis procedures, due to the nature of the analytical procedure. Since there are no reagents, digestions, or other steps in the process that provide significant opportunities for sample contamination or analyte loss, lot blanks and sample spikes are not performed. Instead, all analyses are performed using the following steps:

- Incoming samples are divided into lots of ten for analysis.
- One sample is selected at random to serve as the QC check and divided into two containers.
- The sample lot is assigned to an analyst who determines the asbestos content of each sample.
- The QC sample is analyzed by a different analyst, designated by the sample custodian.
- The results of both analysts are submitted to the QC Coordinator for review, and comparison to the laboratory QC chart.
- The results are reviewed and approved, based on the written QC review procedures, or rejected. If rejected, the sample lot and QC sample are reanalyzed.

The WESTON laboratory routinely runs blank checks to ensure that equipment and refractive index oils are not contaminated, collects and analyzes samples of the air in the work areas to document that airborne asbestos fibers do not threaten worker health or contaminate samples, and analyzes samples submitted by NIST to document precision of results as required by the NVLAP program. Samples provided in past rounds of proficiency checks are used for analyst training and to document analyst proficiency. The use of third party laboratory comparisons is often done, and is accomplished by sending duplicates of samples to an outside laboratory and comparing the results obtained by the two facilities.

In interpreting the asbestos results, it should be noted that the definition of asbestos presence differs between the EPA and some state agencies. According to the EPA definition, any materials that contain greater than one per cent (>1%) asbestos are classified as ACM by the 1977 NESHAP regulations. However, California has recently implemented state regulations that consider all materials containing 0.1 per cent or more asbestos as asbestos-containing. It is believed that several other states will soon follow the lead of California in lowering the threshold limit to 0.1 per cent, including some in which properties under review in this study are located. Currently the State of Washington continues to abide by the EPA definition, hence, all samples containing >1% asbestos are considered to be ACM.

The matter is further complicated by the fact that the PLM method was developed specifically for friable materials, but not for non-friable types of suspect ACM such as vinyl floor tiles, vinyl sheeting, and siding. In fact, no specific method has been developed and promulgated to date for such samples, so laboratories use PLM as the only available documented procedure for their analysis. PLM has an inherent limitation on fiber resolution of about 0.25 micrometer (um) in diameter, while reliable detection and quantification of fibers smaller than 1 um in diameter is difficult. The manufacturing process for vinyl floor tiles, for example, often produces the very small fiber diameters which cannot be seen by PLM. WESTON's

experience is that frequently such samples do, in fact, contain significant quantities of asbestos. WESTON has developed a qualitative technique using TEM to detect the presence of such small fibers and minimize false negatives in the laboratory results. This technique, however, does not allow a good quantitative estimate of asbestos content.

For these reasons, the WESTON laboratories have implemented a policy of reporting asbestos presence as follows:

- Asbestos determined by PLM to be present at greater than 1% is reported as the quantity detected.
- If asbestos is estimated to be less than 1% by PLM, it is reported as "<1%". This estimate of asbestos content may be made when only one asbestos structure is observed.
- If asbestos is not detected in certain non-friable materials by PLM, then the samples are subjected to TEM analysis. The results are reported as positive if asbestos is detected by TEM.

Recommendations made in this report are based on the >1% regulatory limit, except for floor tiles as discussed earlier and except as otherwise noted. However, all samples in which asbestos was detected are discussed. This represents a conservative approach to the assessment of asbestos presence at the facility.

Table 2.1 contains a summary of all samples collected at the Kent FHU, including sample locations, material descriptions, and laboratory results. PLM results are quantitative while TEM results are qualitative. Quantity estimates for materials sampled that were suspected to contain asbestos are presented in Table 2.2. The field notes describing the observations are provided in Appendix A.1, while copies of the original laboratory reports are included as Appendix A.2.

Four of the floor covering samples were found by PLM to contain asbestos at or greater than the 10% level. Three other samples were found by PLM to contain asbestos, but at a concentration of <1%. One of the samples, for which no asbestos was reported following PLM analysis, was found to contain asbestos fibers by the TEM procedure. While this result is qualitative in nature, consideration of the process through which floor tiles were manufactured leads to the conclusion that this material should be treated as ACM. Thus, all of the eight floor tile and vinyl sheeting samples were found to contain asbestos. The 29 units not inspected should be considered to have ACM present in the floor tiles and vinyl sheeting unless additional sampling and analysis is performed and shows that no asbestos is present in these units.

Analytical results for the dust samples taken from the heater ductwork indicate that this dust contains some asbestos fibers. Qualitative TEM analyses revealed the presence of asbestos in all of the twelve dust samples. At least two samples from each unit had detectable asbestos fibers. These data lead to the conclusion that asbestos is found in the dust trapped by the heating ducts.

TABLE 2.1  
BULK SAMPLE SUMMARY  
MIDWAY FAMILY HOUSING

SAMPLE IDENTIFICATION	MATERIAL TYPE	LOCATION	ASBESTOS CONTENT PLM ANALYSIS	CONFIRMATION TEM ANALYSIS
-----				
Unit M06 -----				
BU103-19-WA-M06-AFT	Lt green vinyl sheeting	Bathroom 1/Bathroom 2/ Kitchen	None Detected	Positive
BU104-19-WA-M06-AFT	Tan 12" x 12" floor tile	All bedrooms/Hall/ Living room	Chrysotile, <1%	
BU105-19-WA-M06-ATD	Dust within ductwork	Bathroom 1	---	Positive
BU106-19-WA-M06-ATD	Dust within ductwork	Living room	---	Positive
BU107-19-WA-M06-ATD	Dust within ductwork	Bedroom 3	---	Positive
BU108-19-WA-M06-ATD	Dust within ductwork	Bedroom 2	---	Positive
Unit M10 -----				
BU109-19-WA-M10-AFT	Green 9" x 9" floor tile	Living room/Hall/ Bedroom 2	Chrysotile, 10%	
BU110-19-WA-M10-AFT	Tan 12" x 12" floor tile	All bedrooms/Hall/ Living room	Chrysotile, <1%	
BU111-19-WA-M10-AFT	Brown 9" x 9" floor tile	Hall	Chrysotile, 10%	
BU112-19-WA-M10-AFT	Lt green vinyl sheeting	Bathroom 1/Bathroom 2/ Kitchen	Chrysotile, 10%	
BU113-19-WA-M10-ATD	Dust within ductwork	Bathroom 1	---	Positive
BU114-19-WA-M10-ATD	Dust within ductwork	Living room	---	Positive
BU115-19-WA-M10-ATD	Dust within ductwork	Hall	---	Positive
BU116-19-WA-M10-ATD	Dust within ductwork	Bedroom 3	---	Positive
Unit M21 -----				
BU117-19-WA-M21-AFT	Tan 12" x 12" floor tile	All bedrooms/Hall/ Living room	Chrysotile, <1%	
BU118-19-WA-M21-AFT	Lt green vinyl sheeting	Bathroom 1/Bathroom 2/ Kitchen	Chrysotile, 20%	
BU119-19-WA-M21-ATD	Dust within ductwork	Living room	---	Positive
BU120-19-WA-M21-ATD	Dust within ductwork	Bathroom 1	---	Positive
BU121-19-WA-M21-ATD	Dust within ductwork	Bedroom 2	---	Positive
BU122-19-WA-M21-ATD	Dust within ductwork	Hall	---	Positive

TABLE 2.2  
ASBESTOS CONTAINING MATERIALS  
MIDWAY FAMILY HOUSING

SAMPLE IDENTIFICATION	MATERIAL TYPE	LOCATION	QUANTITY	UNITS
-----				
Unit M06 -----				
BU103-19-WA-M06-AFT	Lt green vinyl sheeting	Bathroom 1/Bathroom 2/ Kitchen	166	Square ft
BU104-19-WA-M06-AFT	Tan 12" x 12" floor tile	All bedrooms/Hall/ Living room	979	Square ft
BU105-19-WA-M06-ATD	Dust within ductwork	Bathroom 1	N/A	
BU106-19-WA-M06-ATD	Dust within ductwork	Living room	N/A	
BU107-19-WA-M06-ATD	Dust within ductwork	Bedroom 3	N/A	
BU108-19-WA-M06-ATD	Dust within ductwork	Bedroom 2	N/A	
Unit M10 -----				
BU109-19-WA-M10-AFT	Green 9" x 9" floor tile	Living room/Hall/ Bedroom 2	30	Square ft
BU110-19-WA-M10-AFT	Tan 12" x 12" floor tile	All bedrooms/Hall/ Living room	720	Square ft
BU111-19-WA-M10-AFT	Brown 9" x 9" floor tile	Hall	8	Square ft
BU112-19-WA-M10-AFT	Lt green vinyl sheeting	Bathroom 1/Bathroom 2/ Kitchen	197	Square ft
BU113-19-WA-M10-ATD	Dust within ductwork	Bathroom 1	N/A	
BU114-19-WA-M10-ATD	Dust within ductwork	Living room	N/A	
BU115-19-WA-M10-ATD	Dust within ductwork	Hall	N/A	
BU116-19-WA-M10-ATD	Dust within ductwork	Bedroom 3	N/A	
Unit M21 -----				
BU117-19-WA-M21-AFT	Tan 12" x 12" floor tile	All bedrooms/Hall/ Living room	758	Square ft
BU118-19-WA-M21-AFT	Lt green vinyl sheeting	Bathroom 1/Bathroom 2/ Kitchen	197	Square ft
BU119-19-WA-M21-ATD	Dust within ductwork	Living room	N/A	
BU120-19-WA-M21-ATD	Dust within ductwork	Bathroom 1	N/A	
BU121-19-WA-M21-ATD	Dust within ductwork	Bedroom 2	N/A	
BU122-19-WA-M21-ATD	Dust within ductwork	Hall	N/A	



## 2.4 CONCLUSIONS AND RECOMMENDATIONS

The sample analyses performed by WESTON have revealed that asbestos is present in most floor tile and vinyl sheeting samples collected in the three housing units examined and that the dust inside the heater supply ducts contains asbestos. These units are thought to be representative of the other 29 at the site, but this was not confirmed by sampling all units. The suspect materials observed by the field team, and any hidden suspect materials found later, should be analyzed for the presence of asbestos prior to being disturbed.

The asbestos dust accumulated within the heating ductwork represents an unusual problem, since the source of this asbestos is not readily apparent, and the quantity is not precisely known. As a conservative approach, the heating ductwork located within the concrete slab should be cleaned or permanently sealed when the units are renovated. Since the heating systems are currently operational, sealing the floor vents will require replacement with attic ducts and ceiling vents, or provisions of an alternate heating source. If the ducts are cleaned, a high-powered vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter should be employed, since other vacuum cleaners are not capable of trapping all of the small asbestos fibers that may be present.

The source of the asbestos in the ducts cannot be positively determined, due to the sampling and analysis procedures employed. However, there are several potential sources, based on observations at the numerous facilities inspected during this project. Units, presumed to be the original heaters, found at other facilities frequently contained an expansion joint which served to isolate the return air plenum from the heater itself, preventing the transmission of vibrations and noise to the ductwork. The fabric-like material used to form this joint was determined, in some cases, to be chrysotile asbestos in a nearly pure form. It is possible, even likely, that the heating systems in these units had similar expansion joints which have been removed. During the 25 to 30 years that the original units were in service, erosion of these joints was likely, and could have caused asbestos fibers to accumulate in the dust.

Another possibility is that residual debris from the removal of vinyl-asbestos floor tiles, such as was found in other sites, may have been left in the ducts during floor tile removal and replacement. Conversations with the TEM analysis indicate that there was some evidence of chlorine observed during the identification of the asbestos fibers by X-ray dispersion analysis in samples from some sites. The most likely source of this element, considering the site history, is the vinyl chloride polymer which forms the floor tile matrix. However, other asbestos sources, such as debris imported into the facilities from outside activities of the occupants, cannot be ruled out.

The vinyl floor coverings in the three housing units inspected were in good condition, but, should they become broken or damaged, asbestos fibers may be released. The recent EPA clarification of the definition for damaged non-friable materials apparently removes some concerns about the status of these materials at the time of renovation or demolition. Inspection of these normally non-friable materials prior to demolition is required, but, if they are in good condition at the time, they may be left in place as long as planned demolition procedures will not release a significant amount of asbestos fibers. However, if demolition will subject these non-friable materials to grinding, sanding, or abrading, or if demolition involves burning of the structure or debris from the structure, all forms of ACM, including these floor tiles, must be removed in advance.

The vinyl floor coverings should be left in place and managed under an O&M plan. An O&M plan must address the following:

- The locations of all known and suspected ACM.
- The procedures and frequency for periodically assessing the ACM in the facility.
- The procedures for safely handling the ACM during maintenance or removal activities.
- Designation of an asbestos coordinator for the facility.
- The responsibilities and requirements for training of personnel involved with maintenance and renovation of the facility.
- The record-keeping program for the facility.

The vinyl floor tiles should be removed during a planned renovation of the units, in accordance with the regulations applicable at the time.

Granular spray-applied paint, furnace gaskets, and expansion joints were the only suspect materials noted, and these should be managed under an O&M program. Care should be taken during renovations or demolition to identify other suspect materials that may have been hidden from the view of the assessment team. The suspect materials observed by the field team, and any hidden suspect materials found later, should be analyzed for the presence of asbestos prior to being disturbed.

SECTION 3. AIRBORNE ASBESTOS ASSESSMENT

### SECTION 3. AIRBORNE ASBESTOS ASSESSMENT

Sampling for airborne asbestos fibers was performed at one unit of the Midway FHU on 12 April 1990 by WESTON. Dr. Bruce Ferguson, a Certified Industrial Hygienist (CIH) visited the site and collected the samples using procedures described in the Asbestos Hazard Emergency Response Act (AHERA). These procedures were designed for verifying that clean-up of a contained area, following completion of an asbestos abatement action in public schools, was adequately performed. All samples were analyzed by TEM following the protocols specified in AHERA.

#### 3.1. SAMPLING RATIONALE

WESTON followed the procedures and guidelines set forth during discussions among ANL, USATHAMA, and WESTON staff members, to provide a fast-track field sampling program and rapid analysis of samples collected. The urgency of this effort was driven by the finding that asbestos fibers were a component of the dust contained in the sub-slab ductwork of a number of the installations. The approach chosen required that the WESTON CIH collect four samples of air from selected heating registers, generally from one in each of the living room, kitchen, bedroom, and bathroom. Air samples were to be collected in one unoccupied unit at the site while the heating system was operating, to simulate the worst possible case for exposure of occupants. The vacant unit selected was to be one of those from which dust within ducts had been sampled during the initial investigations, where possible. If no unit that had been sampled previously was vacant at the time, another unit was to be chosen from among those available, and samples of dust from the ducts were to be collected. These samples were to be collected after completion of sampling for airborne fibers, using the procedures employed previously. Unit 15 was selected at the Midway site, since it was vacant and had previously been sampled.

#### 3.2. FIELD ACTIVITIES AND OBSERVATIONS

The sampling activities at this site were performed during the afternoon, on a warm spring day. The diaphragm pumps were unpacked, placed in the selected sampling locations, and turned on as soon as possible after arrival at the site to allow the mechanical components to warm up prior to checking flow rates. The heating system was turned on as soon as the pumps were in operation, to allow the air flow to stabilize, since it had not been in operation recently.

A test filter cassette, identical to those used for sample collection, was placed on the pump system being calibrated and the airflow into the filter was measured using a calibrated rotameter. This followed AHERA requirements and good industrial hygiene (IH) sampling protocols. After the pumps were calibrated, a sampling cassette made of an electrically conducting plastic was attached to the sample line, placed directly over the heating register to be sampled, and securely held in place with duct tape. The cassette contained a 25 mm diameter mixed cellulose ester (MCE) membrane filter, having a nominal pore size of 0.45  $\mu$ m. The time at which sample collection was begun was recorded and the air was sampled for approximately three hours.

The pumps were operated for a length of time sufficient to draw about 1,600 liters (L) of air through each filter, based on the initial daily calibration. At the expiration of this time, the filter cassettes were removed from the heating register, inverted while the airflow continued, and lightly tapped to dislodge any

fibers that may have adhered to the cowl of the cassette. Then, the cassettes were carefully removed from the sampling pump, resealed with the plugs and end caps that are a part of the cassettes, and labeled. The flow rate of each pump was again determined by exactly the same procedure used prior to the start of sample collection. After all sampling was completed, the heating system was returned to the same condition and setting that was found on entry to the unit.

The volume of air drawn through each filter was calculated, based on the average sample flow rate and the duration of sample collection, and recorded on the cassette label. Each cassette was then sealed in an anti-static plastic zipper-seal bag and placed in a shipping carton with a custom-designed anti-static foam liner. All sampling equipment, samples and other gear were then removed from the unit and the site was secured prior to departure.

Samples were collected from the four interior locations selected. In addition, a field blank was prepared and a background sample of ambient outside air was taken near the entry door to the kitchen. No significant problems were encountered during the sample collection activities. After completion of air sampling, a dust sample was taken from the kitchen vent using the procedures described in the ANL SAP.

During the sampling effort the facility was examined to identify any potential sources of asbestos that may be responsible for the asbestos fibers found in the dust. The heating system has an expansion joint that appeared to have been in place for some time. This type of material sometimes contains asbestos. The heating ducts themselves appear to be a cementitious material that may contain asbestos.

### 3.3. LABORATORY PROCEDURES AND RESULTS

Samples were shipped to the laboratory soon after collection by common carrier. The dust sample was examined using TEM, as described in Section 2. The four samples of air from within the unit were analyzed by WESTON's NVLAP-accredited TEM facility, using the sample preparation and analytical procedures set forth in the EPA AHERA method. A section of the exposed filter was cut from each sample and three wedges were placed on copper wire grids for TEM mounting. The samples were etched in a plasma asher, which also destroyed some of the organic materials that may have been collected, and vacuum-coated with a thin layer of carbon, embedding the fibers that were on the filter surface. Each carbon-coated grid was placed in a Jaffe wick washer, in which the MCE filter matrix was dissolved and wicked away, leaving behind the carbon film containing any asbestos fibers collected. The grids were then examined and found to be ready for analysis.

Once the sample grids were prepared, each grid was examined by the TEM protocols of AHERA. A specified number of grid openings were scanned looking for fibers that may be asbestos. Typically, between six and ten grid openings had to be examined to comply with the detection limits set forth in the regulations. Whenever a fiber was observed during this examination, the microscopist examined its morphology and determined its elemental composition from the emitted X-ray spectrum. If these indicated that it may be an asbestiform mineral, the crystal lattice structure was examined by observation of its electron diffraction pattern. The fiber was then classified as non-asbestos or by the type of asbestos determined to be present during the analysis, as appropriate.

The results for the four samples from inside Unit 15 are presented in Table 3.1. No asbestos fibers were detected in any of these samples at a limit of detection that was between 0.004 and 0.005 fibers per

TABLE 3.1. RESULTS OF AIRBORNE ASBESTOS SAMPLING AND ANALYSIS  
(ALL VALUES IN FIBERS/CC)

SAMPLE NUMBER	SAMPLE LOCATION	ASBESTOS IN DUST	ASBESTOS CONCENTRATION	ASBESTOS TYPE FOUND
SW-15-LR	Living Room	YES	ND <0.005	ND
SW-15-KI	Kitchen	YES	ND <0.005	ND
SW-15-BR	Bedroom	YES	ND <0.005	ND
SW-15-BA	Bath Room	YES	ND <0.005	ND

ND = Not Detected at the Limit of Detection Cited.

Note: The asbestos in all dust samples was chrysotile.

cubic centimeter (f/cc). Based on these findings, the background sample and field blank were not examined, since no fibers were detected inside the unit. Asbestos was found in the three dust samples previously collected in this unit, as well as in the sample collected from the kitchen area vent. This means that asbestos was found in all of the ten samples of dust collected in units at this location.

### 3.4 CONCLUSIONS AND RECOMMENDATIONS

The air samples collected indicate that asbestos fibers from the dust found within the heating system ductwork are not being released in significant quantities at this facility. The airborne asbestos concentration was lower than the detection limit and below the AHERA threshold. The limits of detection were <0.005 f/cc, which is at or below the acceptability limit set forth in AHERA for clearance of an abatement area in a school, and were far lower than the OSHA Permissible Exposure Limit (PEL) for workers of 0.2 f/cc.

While asbestos has been shown to pose a health risk to humans at high fiber concentrations, there are no definitive studies that indicate that a risk is associated with low-level exposures such as the 0.005 f/cc AHERA limit. Therefore, sampling and analysis for airborne asbestos at this site did not reveal any health risk to the occupants of the houses, based on the TEM analysis of the samples collected. However, it is recommended by the U.S. Army Environmental Hygiene Agency (AEHA) that, if the units are to remain under the management, operational control, or ownership of the Army, additional sampling and analysis for airborne asbestos be undertaken. These studies should be performed to provide data from at least ten percent or a minimum of three of the housing units, whichever is greater. This additional sampling and analysis effort, along with the other recommended actions, will help to ensure that there is no long-term exposure risk to the occupants or to maintenance personnel.

#### SECTION 4. SUMMARY OF FINDINGS

Sampling and analyses performed at the Midway FHU in Kent, Washington reveal the presence of issues of concern from an environmental standpoint. The most significant are the detection of asbestos in 11 of the 16 dust samples and in six of nine samples of floor tile and vinyl sheeting.

The following practices should be observed with regard to the known and suspected asbestos-containing materials identified:

- Additional sampling and analysis for airborne asbestos at this site is recommended by AEHA, if the units are to remain under the management, operational control, or ownership of the Army. These studies should be performed to provide data from at least ten percent or a minimum of three of the housing units, whichever is greater.
- The vinyl floor coverings pose no significant risk as long as they are in good condition and are not damaged by excessive wear or misuse. They should be left in place and managed under an O&M program which describes procedures for the regular inspection of the floor coverings and the removal and replacement of any that become damaged.
- Other suspect materials identified at the site, including spray-applied texture paint, furnace gaskets, and expansion joints, should be assumed to contain asbestos and managed in place under an O&M program until they are either removed or determined to contain no asbestos.

The air monitoring performed in Unit 15 indicated that no detectable asbestos was being emitted in air from dust collected in the heating ducts. The detection limit of the method, <0.005 f/cc, is below the AHERA limit and well below the OSHA PEL of 0.2 f/cc.



SECTION 4. SUMMARY OF FINDINGS

APPENDIX A.1. FIELD DATA, ASBESTOS SAMPLING

## SITE SURVEY LOG

CLIENT Argonne National Labs WESTON WORK ORDER NO. 2104-13-01  
 FACILITY BLDG. NO. Midway Family Housing, M-6  
 FACILITY CONTACT Bonny E. Lewis TELEPHONE NUMBER (202) 407-7512  
 TECHNICIAN NAME Michael Skofnicki SIGNATURE Michael Skofnicki  
 TECHNICIAN NAME Rolf Engel SIGNATURE Rolf Engel  
 TIME ARRIVED 1155 TIME DEPARTED 1220 DATE 20 Feb 90  
 dd mm yy

## SPECIFIC SITE ACTIVITIES, COMMENTS, INTERVIEW RESULTS &amp; BRIEF DESCRIPTION OF FACILITY

Based on conversations with Joe Behrent, Family Housing Engineer, on Feb 6, 1990, no buildings in this area have been renovated. Frank Niemke, of our DEH court, has a list of three buildings that the DEH has arranged for us to survey. These three buildings represent one of each style of house at Midway.

House is a three bedroom Capehart style structure. One story, wood frame, concrete foundation, and tar and gravel roof. Inside has vinyl floor tile and plaster board walls. There is a granular, epoxy on floor on walking and walls. Carpet has no transite siding. There is also R2 pipe insulation. There is an expansion joint, and a furnace gasket on heating unit.

No dust sample taken in kitchen. No dust <sup>vent</sup> in this area.

## ACTIVITY CHECKLIST

Interviews Completed <u>No</u>	Number of Samples <u>6</u>
Drawings Reviewed <u>No</u>	Survey Form Completed <u>Yes</u>
Drawings Attached <u>Yes</u>	Site Log Completed <u>Yes</u>
Visual Inspection <u>Yes</u>	Chain-of-Custody Initiated <u>Yes</u>
Number of Photos <u>0</u>	Exp. Assess. Form Init. <u>Yes</u>
Q.A. Check <input checked="" type="checkbox"/>	SIGNATURE <u>Michael Skofnicki</u> DATE <u>21 MAR 90</u> dd mm yy

# ASBESTOS SURVEY DATA

0655

BLDG. NO.: M1016  
INSTALLATION 01119

## TASK TEAM MEMBERS

Michael Kindley  
R. It Erga

W.O. No. 2104-13-01  
CLIENT: ARGONNE NATIONAL LAB

BLDG. NAME: Family Housing M-06  
BLDG. DESCRIPTION: Capehart Style

DATE (dd/mm/yy): 20/02/90  
TIME ARRIVED: 1155

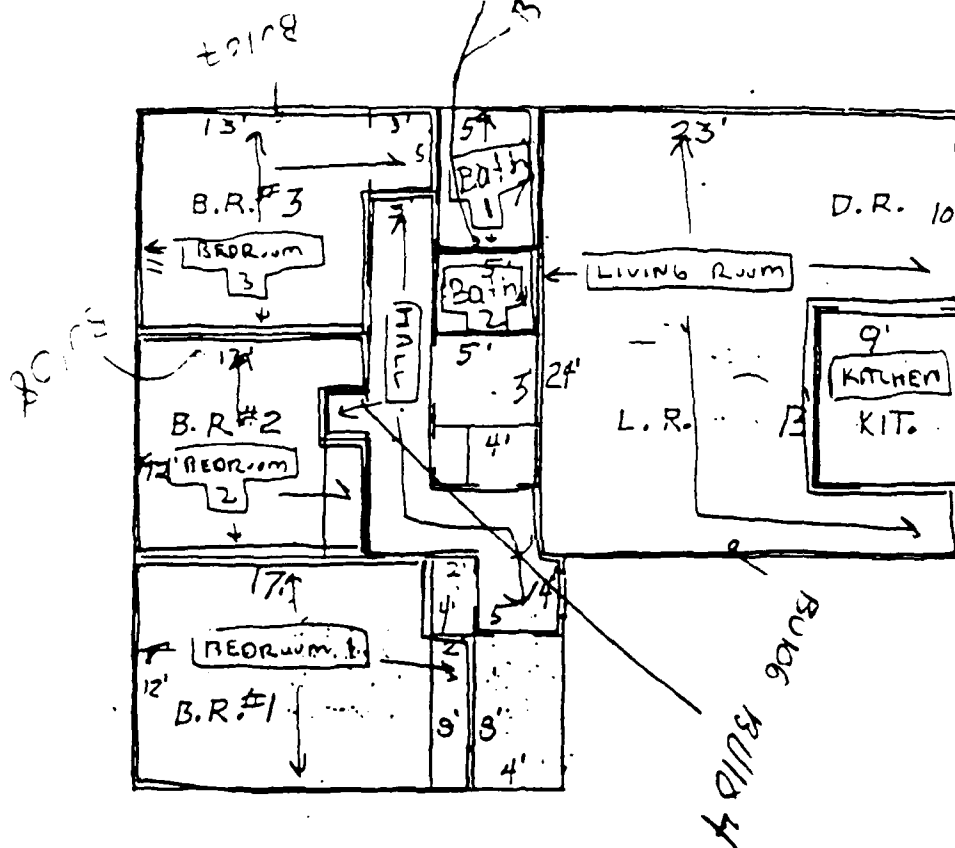
ITEM NO.	LAB SAMPLE NO.	BASE NO.	STATE	UNIT NO.	SAMPLE CODE	AREA	QUANTITY	PHOTO	E.A. FORM NO.	NOTES
1.	B1011013-119-WIA-M1016-AIFIT					B1011013-119-WIA-M1016-AIFIT	1166	-	111241F	01
2.	B1011014-119-WIA-M1016-AIFIT					B1011014-119-WIA-M1016-AIFIT	1166	-	111241F	02
3.	B1011015-119-WIA-M1016-AITD					B1011015-119-WIA-M1016-AITD	1166	-	111241F	03
4.	B1011016-119-WIA-M1016-AITD					B1011016-119-WIA-M1016-AITD	1166	-	111241F	03
5.	B1011017-119-WIA-M1016-AITD					B1011017-119-WIA-M1016-AITD	1166	-	111241F	02
6.	B1011018-119-WIA-M1016-AITD					B1011018-119-WIA-M1016-AITD	1166	-	111241F	03
7.	1111-1-1-1-1-1-A11					1111-1-1-1-1-1-A11	1166	-	111241F	01
8.	1111-1-1-1-1-1-A11					1111-1-1-1-1-1-A11	1166	-	111241F	1
9.	1111-1-1-1-1-1-A11					1111-1-1-1-1-1-A11	1166	-	111241F	1
10.	1111-1-1-1-1-1-A11					1111-1-1-1-1-1-A11	1166	-	111241F	1
11.	1111-1-1-1-1-1-A11					1111-1-1-1-1-1-A11	1166	-	111241F	1
12.	1111-1-1-1-1-1-A11					1111-1-1-1-1-1-A11	1166	-	111241F	1

NOTE NO.	NOTES/REMARKS/COMMENTS/DETAILS/OTHER MATERIALS, QUANTITY, ETC.
01	Light green rolled flooring (linoleum). Occurs also in Bathroom 2 and Kitchen
02	Tan 12" x 12" floor tile. Material also occurs in Bedroom 1, Bedroom 2, Bedroom 3, living Room. Closets are included in areas of the rooms in which they occur.
03	Dust in floor level heat ducts
04	Spray-on granular paint on walls and ceiling. Cloth expansion joint on heating unit; also gasket between furnace and blower unit. Not sampled.

TECHNICIAN SIGNATURE Michael Kindley

QUALITY ASSURANCE SIGNATURE Michael Skotnicki

BU 103  
BU 105



Bulk Bully

REESE HOWARD #49  
762-8789 2+y  
878-1813 hm

## SITE SURVEY LOG

CLIENT Argonne National Labs WESTON WORK ORDER NO. 2104-13-01  
 FACILITY BLDG. NO. Midway Family Housing M-10  
 FACILITY CONTACT Bobby E. Lewis TELEPHONE NUMBER (206) 207-4512  
 TECHNICIAN NAME Michael Kindley SIGNATURE Michael Kindley  
 TECHNICIAN NAME Rolf Ege SIGNATURE Rolf Ege  
 TIME ARRIVED 1225 TIME DEPARTED 1300 DATE 20 Feb 90  
 dd mm yy

## SPECIFIC SITE ACTIVITIES, COMMENTS, INTERVIEW RESULTS &amp; BRIEF DESCRIPTION OF FACILITY

Building is a three bedroom, Capehart-style house with vinyl flooring and plasterboard walls inside. There is a granular, spray-on paint on inside walls and ceiling. Structure is one story, wood framed, with a concrete foundation, and tar and gravel roof.

There are no transite shingles on outside walls, or pipe insulation on hot water pipes.

Expansion joint and furnace gasket found on heater unit.

## ACTIVITY CHECKLIST

Interviews Completed	<u>No</u>	Number of Samples	<u>8</u>
Drawings Reviewed	<u>No</u>	Survey Form Completed	<u>Yes</u>
Drawings Attached	<u>Yes</u>	Site Log Completed	<u>Yes</u>
Visual Inspection	<u>Yes</u>	Chain-of-Custody Initiated	<u>Yes</u>
Number of Photos	<u>0</u>	Exp. Assess. Form Init.	<u>Yes</u>
Q.A. Check <input checked="" type="checkbox"/>	SIGNATURE <u>Michael Skutnicki</u>		DATE <u>21 MAR 90</u>
			dd mm yy

# ASBESTOS SURVEY DATA

0659

BLDG. NO.: M1110  
INSTALLATION 01119

## TASK TEAM MEMBERS

Michael Kindley  
Rolf Erga

W.O. No. 2104-13-01  
CLIENT: ARGONNE NATIONAL LAB

BLDG. NAME: Midway Family Housing MtU  
BLDG. DESCRIPTION: Capehart style

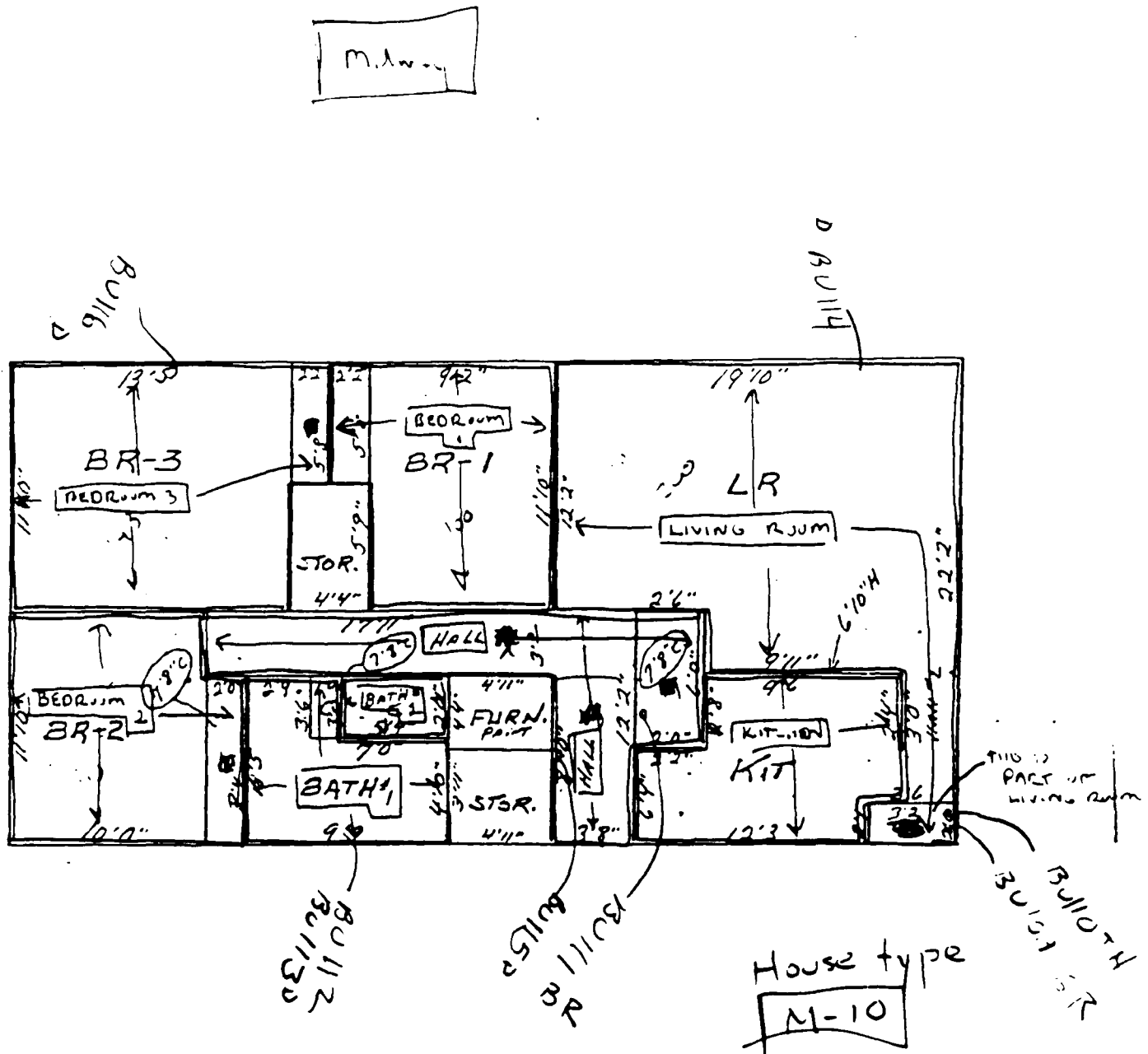
DATE (dd/mm/yy): 20/02/90  
TIME ARRIVED: 1225

ITEM NO.	LAB SAMPLE NO.	BASE NO.	STATE	UNIT NO.	SAMPLE CODE	AREA	QUANTITY	PHOTO	E.A. FORM NO.	NOTES
1.	B01109-119-WA-M110-A1F1T					LIVING ROOM	1310	-	111251A	01
2.	B01110-117-WA-M110-A1F1T					LIVING ROOM	1720	-	111251B	02
3.	B01111-117-WA-M110-A1F1T					HALL	1118	-	111251C	03
4.	B01112-117-WA-M110-A1F1T					BATHROOM	1117	-	111251D	04
5.	B01113-117-WA-M110-A1F1D					BATHROOM	1117	-	111251D	05
6.	B01114-117-WA-M110-A1F1D					LIVING ROOM	1117	-	1117	015
7.	B01115-117-WA-M110-A1F1D					HALL	1117	-	1117	015
8.	B01116-117-WA-M110-A1F1D					BEDROOM	1117	-	1117	015
9.	1111-1-1-1-1-1-1					NOTES	1117	-	1117	015
10.	1111-1-1-1-1-1-1					1117	1117	-	1117	1
11.	1111-1-1-1-1-1-1					1117	1117	-	1117	1
12.	1111-1-1-1-1-1-1					1117	1117	-	1117	1

NOTE NO.	NOTES/REMARKS/COMMENTS/DETAILS/OTHER MATERIALS. QUANTITY, ETC.
01	Green 9"x9" floor tile. Material also in Hall and Bedroom 2
02	Material in closets are included in the area of the room in which the closet occurs.
03	Tan 12"x12" floor tile. Material also occurs in Hall, Bedroom 1, Bedroom 2, and Bedroom 3
04	Brown 9"x9" floor tile.
05	Light green rolled flooring (linoleum) Also occurs in Bedroom 2, and Kitchen
06	Dust in floor level ducts
07	Granular spray-on paint on inside walls and ceiling Expansion joint on furnace. Gasket between furnace and motor vent connection Not sampled.

TECHNICIAN SIGNATURE Michael Kindley

QUALITY ASSURANCE SIGNATURE Michael Skofnick



M-10

WHITE MARY

#50

281-3092 DTY

87E-2696 1m



0661

## SITE SURVEY LOG

CLIENT Argonne National Labs WESTON WORK ORDER NO. 2104-13-01

FACILITY/BLDG. NO. Midway Family Housing, M-21

FACILITY CONTACT Benny E. Lewis TELEPHONE NUMBER (206) 967-4512

TECHNICIAN NAME Michael F. Kintley SIGNATURE Michael Kintley

TECHNICIAN NAME Ruf Egan SIGNATURE Ruf Egan

TIME ARRIVED 1305 TIME DEPARTED 1325 DATE 20 Feb 90  
dd mm yy

## SPECIFIC SITE ACTIVITIES, COMMENTS, INTERVIEW RESULTS &amp; BRIEF DESCRIPTION OF FACILITY

Building is a three bedroom, Capehart-style house with vinyl flooring and plaster board walls inside. There is a granular, spray-on paint on inside walls and ceiling. Structure is one story, wood framed, with a concrete foundation, and tar and gravel roof.

There are no transite shingles on outside, nor pipe insulation inside.

There is a worn, cloth separation joint on the heating unit, and a gasket between the furnace and the motor connection.

\* We drove around and checked other houses for transite siding, and could find none.

## ACTIVITY CHECKLIST

Interviews Completed	<u>No</u>	Number of Samples	<u>6</u>
Drawings Reviewed	<u>No</u>	Survey Form Completed	<u>Yes</u>
Drawings Attached	<u>Yes</u>	Site Log Completed	<u>Yes</u>
Visual Inspection	<u>Yes</u>	Chain-of-Custody Initiated	<u>Yes</u>
Number of Photos	<u>0</u>	Exp. Assess. Form Init.	<u>Yes</u>
Q.A. Check <input checked="" type="checkbox"/>	SIGNATURE <u>Michael Skotnicki</u>	DATE <u>1/1/90</u>	dd mm yy

## 0668

W.O. No. 2104-13-01

CLIENT: ARGONNE NATIONAL LAB

R. it Ergu

BLDG. NAME: Family Housing M-21

DATE (dd/mm/yy): 20/04/90

BLDG. DESCRIPTION: Cap-hart style

TIME ARRIVED: 1 3 0 2

ITEM NO.	LAB SAMPLE NO.	BASE NO.			UNIT NO.	SAMPLE CODE	AREA	QUANTITY	PHOTO	E.A. FORM NO.	NOTES
		BASE NO.	STATE	UNIT NO.							
1.	D101117	-119	-WA	-M241	-AIFIT	L1V11M01 R1010M	7.58	-	111251E	01	
2.	D101118	-117	-WA	-M241	-AIFIT	D1011M01 R1010M	1.117	-	111251F	02	
3.	D101119	-115	-WA	-M241	-AIFIT	L1V11M01 R1010M	1.117	-	111251F	03	
4.	D101120	-114	-WA	-M241	-AIFIT	D1011M01 R1010M	1.117	-	111251F	04	
5.	D101121	-117	-WA	-M241	-AIFIT	R1010M	1.117	-	111251F	05	
6.	D101122	-117	-WA	-M241	-AIFIT	H1010M	1.117	-	111251F	06	
7.	1111	-1	-1	-1	-A1	N1010E	1.111	-	111251F	07	
8.	1111	-1	-1	-1	-A1	1111	1.111	-	111251F	08	
9.	1111	-1	-1	-1	-A1	1111	1.111	-	111251F	09	
10.	1111	-1	-1	-1	-A1	1111	1.111	-	111251F	10	
11.	1111	-1	-1	-1	-A1	1111	1.111	-	111251F	11	
12.	1111	-1	-1	-1	-A1	1111	1.111	-	111251F	12	

NOTE NO.	NOTES/REMARKS/COMMENTS/DETAILS/OTHER MATERIALS, QUANTITY, ETC.
01	Tan 12' x 12" floor tile. Material used in Hall, Bedroom 1, Bedroom 2, and Bedroom 3. Closets in each room are included with the area of the room within which they occur.
02	Light green rolled flooring ("linoleum"). Also occurs in Bathroom 2, and Kitchen.
03	Dust in floor level ducts. No dust in Kitchen, so sample taken in Hall.
04	Granular, spray-on paint on inside walls and ceiling. Expansion joint on furnace duct. Gasket between furnace and blower unit. Not sampled.
	.

TECHNICIAN  
SIGNATURE

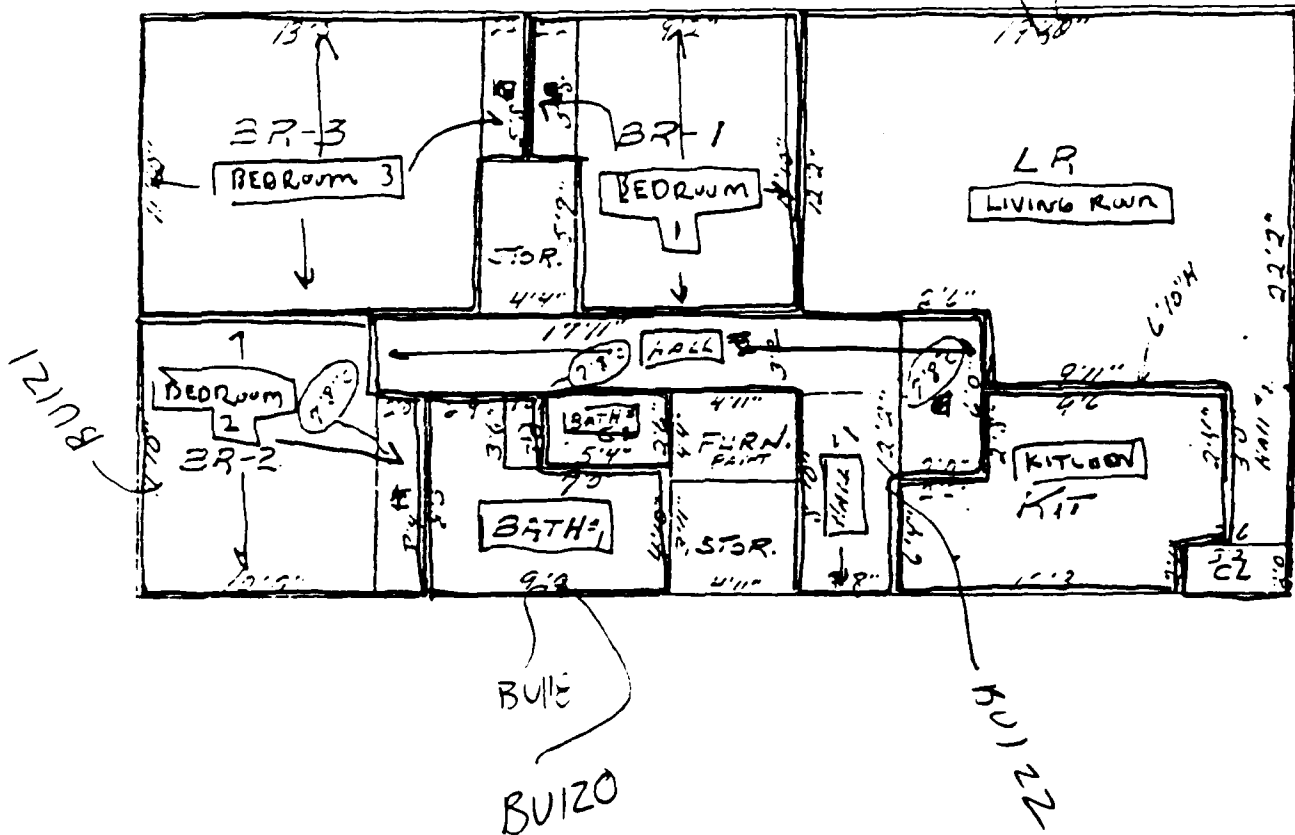
Muhammad Khatib

QUALITY ASSURANCE  
SIGNATURE

Michael Skotnicki

Midway

BU119  
BU117



7-15  
n21

REID JOHN M

#50

AV 744-3295 Dty  
277-9837 hm

APPENDIX A.2. LABORATORY DATA, ASBESTOS SAMPLES

# BULK SAMPLE ANALYSIS SUMMARY

Weston W.O. No. 2104-13-01-0000

Sample Number BU103 through Sample BU118

AO LAB ID NO	CLIENT/CLIENT ID	LOCATION	MATERIAL DESCRIPTION *	DATE RECEIVED	RESULTS **					LAYERS	ANALYST
					CH	AM	CR	OT	TL		
BU103	19-WA-M06-AFT	BATHR1	NF, GR, LINOLEUM	02/22/90	ND	ND	ND	ND	ND	Yes	07323
BU104	19-WA-M06-AFT	HALL	NF, TN, 12X12 FT	02/22/90	<1	ND	ND	ND	<1	Yes	07323
BU109	19-WA-M10-AFT	LIVNRM	NF, GR, 9X9 FT	02/22/90	10	ND	ND	ND	10	Yes	07323
BU110	19-WA-M10-AFT	LIVNRM	NF, TN, 12X12 FT	02/22/90	<1	ND	ND	ND	<1	Yes	07323
BU111	19-WA-M10-AFT	HALL	NF, BR, 9X9 FT	02/22/90	10	ND	ND	ND	10	Yes	07323
BU112	19-WA-M10-AFT	BATHR1	NF, GR, LINOLEUM	02/22/90	10	ND	ND	ND	10	No	07323
BU117	19-WA-M21-AFT	LIVNRM	NF, TN, 12X12 FT	02/22/90	<1	ND	ND	ND	<1	No	07323
BU118	19-WA-M21-AFT	BATHRM	NF, GR, LINOLEUM	02/22/90	20	ND	ND	ND	20	No	07323

MATERIAL DESCRIPTION	FRIABLE <sup>1</sup>	COLOR <sup>2</sup>		SYSTEM <sup>3</sup>
Friable <sup>1</sup> , Color <sup>2</sup> , System <sup>3</sup> , Type	- Friable NF - Non-Friable	BK - Black BL - Blue BR - Brown GR - Green GY - Gray	RD - Red TN - Tan WH - White YL - Yellow	CHW - Chilled Water DOM - Domestic Water HHW - Heating Hot Water STM - Steam UNK - Unknown
RESULTS				
CH - Chrysotile      OT - Other				
AM - Amosite        TL - Total				
CR - Crocidolite				

Upon issue, this report may be reproduced only in full.

All analyses are performed in accordance with the methods set forth in U.S. EPA 600/M4-82-020, as amended. Weston's Optical Microscopy Laboratory is accredited by the National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program for asbestos fiber analysis (Laboratory Code 1254).



ROY F. WESTON, INC.  
1635 PUMPHREY AVE.  
AUBURN, AL 36830  
PHONE: (205) 826-6100  
FAX: (205) 826-8232

## Transmission Electron Microscopy Asbestos Summary Report

Client: Argonne National Laboratories      Weston W.O. No.: 2104-13-01-0000

Sample Type(s): Dust and Floor Tiles      Sampling Location: Midway

### QUALITATIVE ANALYSIS

FLOOR TILES: A 0.5 to 2.0 gram portion of each floor tile sample was ultrasonically disaggregated in four milliliters of deionized, 0.2  $\mu$ m membrane filtered water. After the coarse fraction settled, a drop of the suspended, clay-sized fraction was placed on a Formvar coated 200 mesh Cu TEM grid and allowed to dry. The grid was carbon coated for thermal stability in the electron beam and examined with a Philips CM12 transmission electron microscope operating at 120 kilovolts accelerating voltage.

DUST WIPE SAMPLES: A generous loading of dust was collected on a pre-wetted, 25 square centimeter section of a cleanroom wipe. The wipe was placed in a two ounce wide mouth collection vial and returned to the laboratory. Ten to fifteen milliliters of filtered, deionized water was added to suspend the dust. The suspension was ultrasonically dispersed and the coarse fraction was allowed to settle. A drop of the suspension was placed on a Formvar coated 200 mesh Cu TEM grid and allowed to dry. The grid was carbon coated as above and examined by transmission electron microscopy at 120 kilovolts accelerating voltage.

### ANALYTICAL RESULTS

#### SAMPLE IDENTIFICATION

#### RESULTS

BU103-19-WA-M06-AFT	Positive
BU105-19-WA-M06-ATD	Positive
BU106-19-WA-M06-ATD	Positive
BU107-19-WA-M06-ATD	Positive
BU108-19-WA-M06-ATD	Positive
BU113-19-WA-M10-ATD	Positive



ROY F. WESTON, INC.  
1635 PUMPHREY AVE.  
AUBURN, AL 36830  
PHONE (205) 826-6100  
FAX (205) 826-8232

ANALYTICAL RESULTS  
(continued)

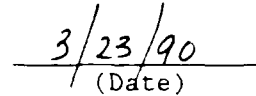
SAMPLE IDENTIFICATION

RESULTS

BU114-19-WA-M10-ATD  
BU115-19-WA-M10-ATD  
BU116-19-WA-M10-ATD  
BU119-19-WA-M21-ATD  
BU120-19-WA-M21-ATD  
BU121-19-WA-M21-ATD  
BU122-19-WA-M21-ATD

Positive  
Positive  
Positive  
Positive  
Positive  
Positive  
Positive

  
\_\_\_\_\_  
(Approved for Transmittal)

  
\_\_\_\_\_  
(Date)

- \* This test report relates only to the specific items tested.
- \*\* These sample results may only be reproduced in full, and are valid only if approved for transmittal.

APPENDIX B.1. FIELD DATA, AIRBORNE ASBESTOS SAMPLING



12 April 1990

Notes by Bruce Ferguson

Project: Argonne National Laboratories

Dust & Air Sampling from Housing Units

Work Order No. 2104-13-~~01-0040~~  
- 02-000/

Went to Ft. Lewis Housing Unit and met with Mr. Bob Lewis. We reviewed the vacant units that we could test and the Midway complex and the Young's Lake complex. None of the units that we had sampled previously were vacant. We randomly selected one of the vacant units in each complex. They gave us keys to the units and we departed.

Larry Si and I arrived at the Midway complex at approximately 9:45 a.m. We got the equipment and calibrated all of the pumps. We started sampling at approximately 10:25.

A sketch of the housing unit M-18 was prepared to locate the registers. We removed the grill and inserted the sampling cassette at the opening of each register. The sample I.D.'s and register locations are shown on the sketch.

At beginning the sampling, the ambient temperature in the room was approximately 50°. It was necessary to turn the heat on to make air flow (There was no fan setting on the thermostat). At the end of the sampling period the temperature in the room was approximately 82°.

Throughout the sampling, the doors and windows were kept closed. The unit heated during the entire sampling period and flow was present in each of the ducts.

The sampling was terminated at approximately 1:00 p.m. Post calibration was performed on each pump and we departed the location.

I arrived at the Young's Lake complex at approximately 2:00 p.m. The sign at the entrance to the complex actually identifies it as Nike Manor. I used the post calibration from the Midway testing and set-up the pumps.

I prepared a sketch of the house and noted the registers that which I sampled. Sampling began at approximately at 2:15 p.m. The ambient temperature at the beginning of the sampling was approximately 65° in the building. After the heater had been on for the duration of the sampling, the temperature was approximately 82°.

All sampling proceeded smoothly. At the completion of the sampling time (approximately 16:30) I recalibrated all pumps, calculated the data and departed the site.

*BMP*

# AIR MONITORING DATA

CLIENT Argonne National Labs WORKER ORDER NUMBER 2104-13-01-0040  
 PROJECT LOCATION Midway Housing  
 WORK AREA ID NO M-18-A Living Room Amt RT SAMPLE NO M-18-A

SAMPLE TYPE	X	Duct
-------------	---	------

SAMPLE DATA	1025	1307	162
70 A+B X	B. Ferguson		9/12/90
2 11.0 11.0			
3 11.0 1782			

ANALYTICAL DATA	TEM

NOTES SKETCHES REMARKS	<p style="text-align: center; font-size: 1.2em;">See master sketch</p>
------------------------	--

# AIR MONITORING DATA

CLIENT Argonne National Labs  
 PROJECT LOCATION Midway Housing  
 WORK AREA ID NO Living Room, Back, Center Register

WORKER ORDER NUMBER 2104-13-01

SAMPLE NO M-18-B

## SAMPLE TYPE

☒ AMBIENT

☒ DUCT

## SAMPLE DATA

99 A+B

2 9.3 9.4  
 3 9.5 1523

1026

1308

162

B. Ferguson

4/12/90

## ANALYTICAL DATA

TEM

## NOTES SKETCHES REMARKS

See master sketch

# AIR MONITORING DATA

CLIENT Argonne National Labs WORKER ORDER NUMBER 2104-13-01-0040  
 PROJECT LOCATION Midway Housing  
 WORK AREA ID NO Bedroom 2 Front 40ft register SAMPLE NO M-18-C

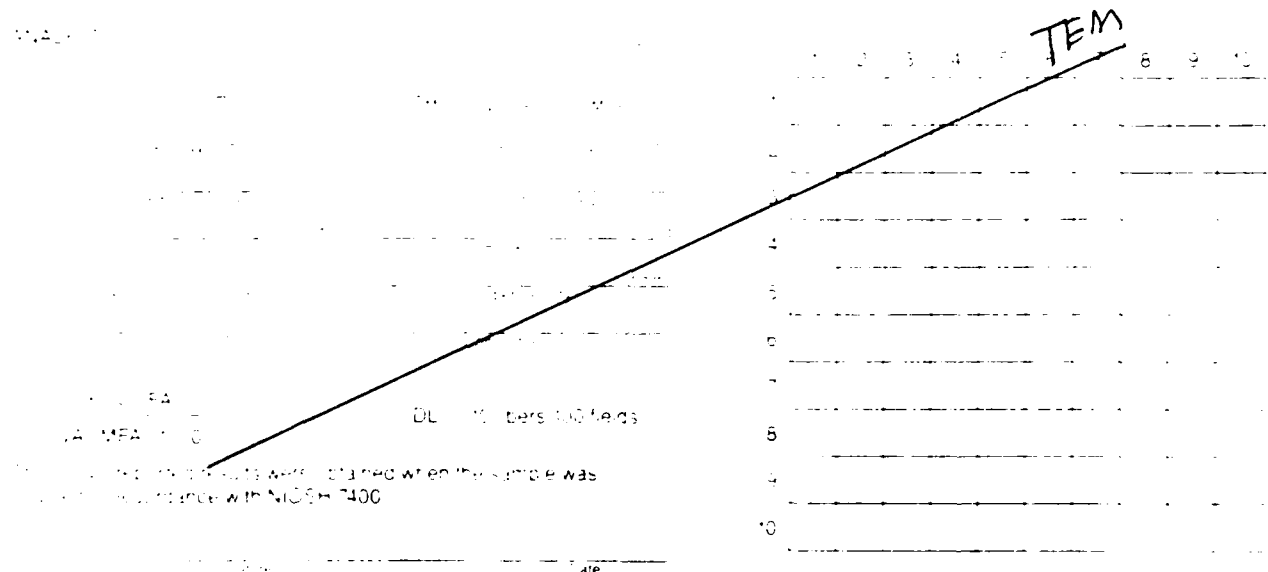
## SAMPLE TYPE

☒ AMBIENT  
☐ AREA  
☐ DUCT  
☐ EXHAUST  
☐ FURNACE  
☐ HEAVY METALS  
☐ HYDROCARBONS  
☐ PARTICULATE  
☐ PESTICIDES  
☐ RADIONUCLIDES  
☐ TRACE ORGANICS  
☐ THERMAL DECOMPOSITION

## SAMPLE DATA

80 A+B X- 1027 1309 162  
 2 10.5 10.5 B. Ferguson 4/14/90  
 3 10.5 1701

## ANALYTICAL DATA



## NOTES SKETCHES REMARKS

See master sketch

# AIR MONITORING DATA

CLIENT Argonne National Labs WORKER ORDER NUMBER 2104-13-01-0040  
 PROJECT LOCATION Midway Housing  
 WORK AREA ID NO Bedroom 3, Backwell, only Register SAMPLE NO M-18-D

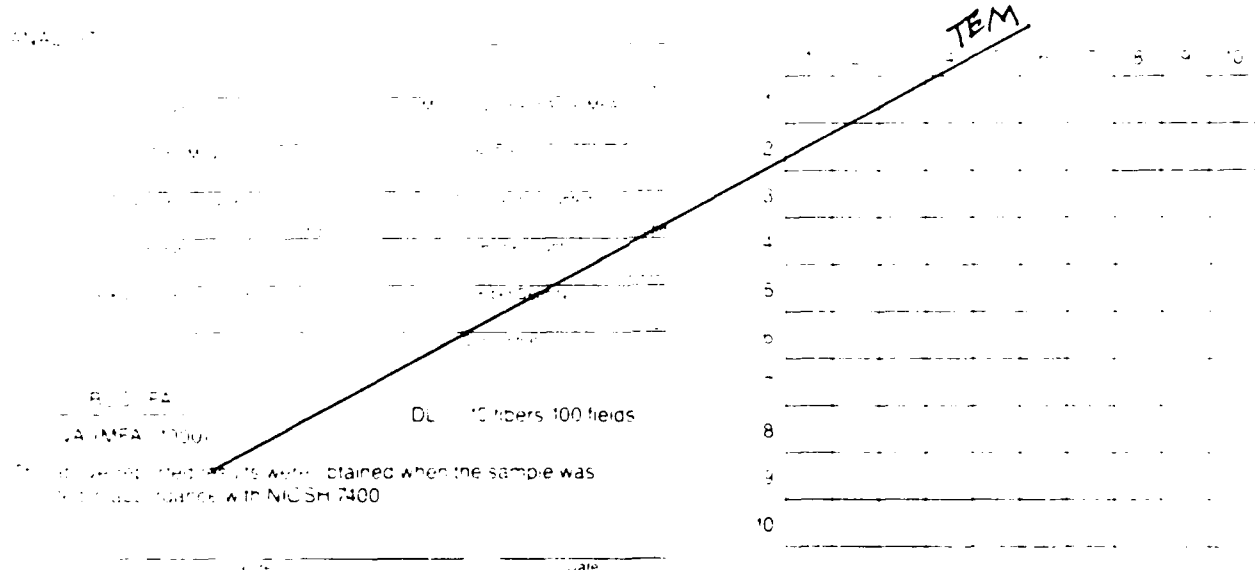
## SAMPLE TYPE

☒ AMBIENT  
☐ AREA  
☐ DUCT  
☐ OTHER

## SAMPLE DATA

1028 1309 161  
 78 A+B B. Ferguson 4/12/90  
 2 9.0 9.0  
 3 9.0 1449

## ANALYTICAL DATA



## NOTES SKETCHES REMARKS

See master sketch

# AIR MONITORING DATA

CLIENT Argonne National Labs WORKER ORDER NUMBER 2104-13-01-0050  
PROJECT LOCATION Midway Housing  
WORK AREA ID NO. outside Back door SAMPLE NO m-18-E

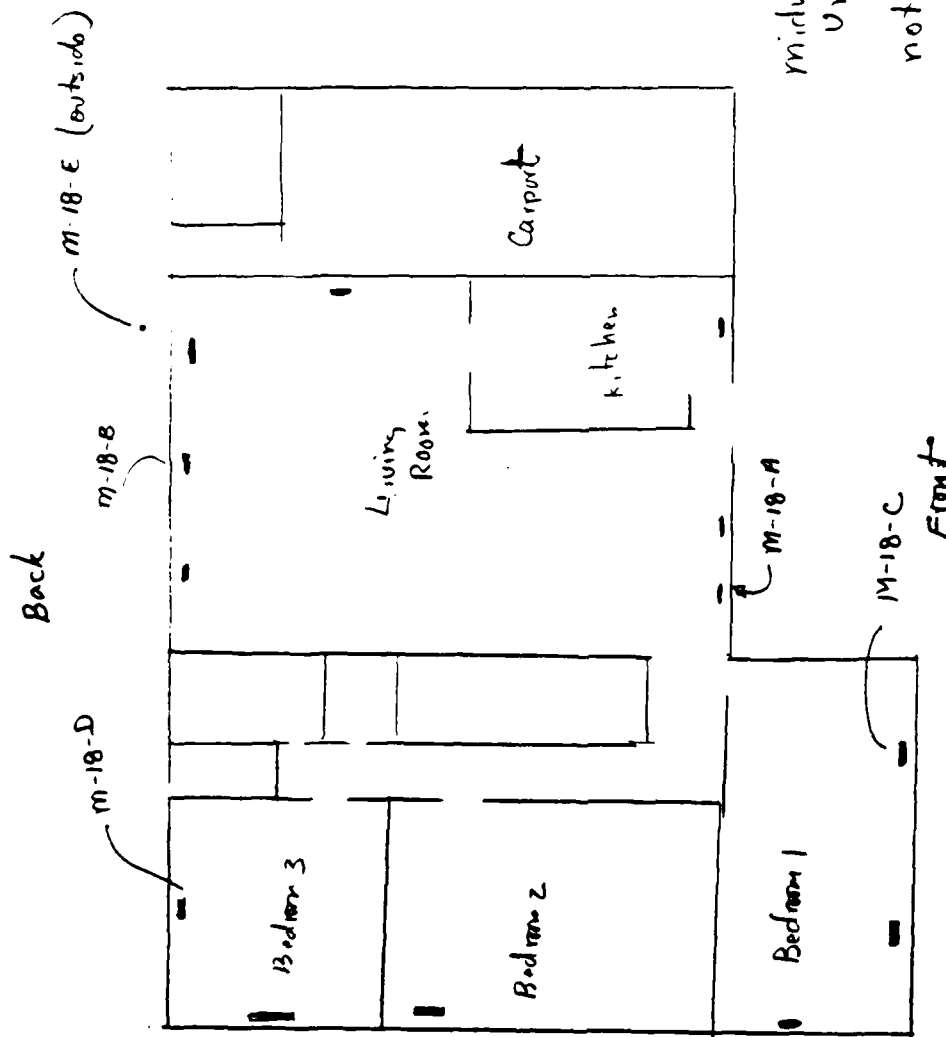
[illegible]

SAMPLE DATA				1022	1310	158
	97 A+B	X		B. Ferguson		4/12/90
	2	10.5	10.8			
	3	11.0	18.4			

[illegible]

NOTES SKETCHES REMARKS

See master sketch



Midway Housing  
Unit M-18  
9/12/90  
not to scale

- represents registers in floor

Sample 10 is both for  
dust and air samples

APPENDIX B.2. LABORATORY, AIRBORNE ASBESTOS SAMPLING





ROY F WESTON, INC.  
1635 PUMPHREY AVE.  
AUBURN, AL 36830  
PHONE (205) 826-6100  
FAX (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-A

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: EE861

Received by: Barry Rayfield  
Analyzed by: Greg Hall

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Filter Type: 0.45  $\mu$ m, 25 mm, MEC  
Number of Grids Examined: 2  
Average Grid Square Area: 0.0088 mm<sup>2</sup>  
Sample Volume: 1782.0 liters  
EPA Analysis: AHERA

Filter Area: 385 mm<sup>2</sup>  
Number of Grid Squares Examined: 5  
Total Area Examined: 0.0440 mm<sup>2</sup>  
Detection Limit: 0.005 fibers/cc  
Grid Archive No.: 0219-C-4,5

ANALYTICAL RESULTS

	<u>Chrysotile</u>		<u>Amphiboles</u>		<u>Ambiguous</u>	<u>Non-Asbestos</u>
	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>		
Number of Fibers Analyzed:	0	0	0	0	0	2
Number of Bundles Analyzed:	0	0	0	0	0	0
Number of Clusters Analyzed:	0	0	0	0	0	0
Number of Matrices Analyzed:	0	0	0	0	0	0

SUMMARY

Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Total Concentration of Asbestos Structures ND (structures/cc)  
Total Concentration of Asbestos Structures ND (structures/mm<sup>2</sup>)

Comments:

  
(Approved for Transmittal)

April 23, 1990  
(Date)

This test report relates only to the specific items tested.



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1635 PUMPHREY AVE  
AUBURN, AL 36830  
PHONE (205) 826-6100  
FAX (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-B

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: EE862

Received by: Barry Rayfield  
Analyzed by: Greg Hall

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Filter Type: 0.45  $\mu$ m, 25 mm, MEC  
Number of Grids Examined: 2  
Average Grid Square Area: 0.0088 mm<sup>2</sup>  
Sample Volume: 1523.0 liters  
EPA Analysis: AHERA

Filter Area: 385 mm<sup>2</sup>  
Number of Grid Squares Examined: 6  
Total Area Examined: 0.0528 mm<sup>2</sup>  
Detection Limit: 0.005 fibers/cc  
Grid Archive No.: 0219-D-2,3

ANALYTICAL RESULTS

	<u>Chrysotile</u>		<u>Amphiboles</u>		<u>Ambiguous</u>	<u>Non-Asbestos</u>
	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>		
Number of Fibers Analyzed:	0	0	0	0	0	1
Number of Bundles Analyzed:	0	0	0	0	0	0
Number of Clusters Analyzed:	0	0	0	0	0	0
Number of Matrices Analyzed:	0	0	0	0	0	0

SUMMARY

Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Total Concentration of Asbestos Structures ND (structures/cc)  
Total Concentration of Asbestos Structures ND (structures/mm<sup>2</sup>)

Comments:

  
(Approved for Transmittal)

April 23, 1990  
(Date)

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1635 PUMPHREY AVE.  
AUBURN, AL 36830  
PHONE: (205) 826-6100  
FAX: (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-C

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: EE863

Received by: Barry Rayfield  
Analyzed by: Beth Hiltbold

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Filter Type: 0.45  $\mu$ m, 25 mm, MEC  
Number of Grids Examined: 2  
Average Grid Square Area: 0.0088 mm<sup>2</sup>  
Sample Volume: 1701.0 liters  
EPA Analysis: AHERA

Filter Area: 385 mm<sup>2</sup>  
Number of Grid Squares Examined: 6  
Total Area Examined: 0.0528 mm<sup>2</sup>  
Detection Limit: 0.004 fibers/cc  
Grid Archive No.: 0219-D-5,E-1

ANALYTICAL RESULTS

	<u>Chrysotile</u>		<u>Amphiboles</u>		<u>Ambiguous</u>	<u>Non-Asbestos</u>
	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>		
Number of Fibers Analyzed:	0	0	0	0	0	3
Number of Bundles Analyzed:	0	0	0	0	0	4
Number of Clusters Analyzed:	0	0	0	0	0	1
Number of Matrices Analyzed:	0	0	0	0	0	2

SUMMARY

Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Total Concentration of Asbestos Structures ND (structures/cc)  
Total Concentration of Asbestos Structures ND (structures/mm<sup>2</sup>)

Comments:

  
(Approved for Transmittal)

April 23, 1990  
(Date)

This test report relates only to the specific items tested.



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1635 PUMPHREY AVE.  
AUBURN, AL 36830  
PHONE: (205) 826-6100  
FAX: (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-D

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: EE864

Received by: Barry Rayfield  
Analyzed by: Barry Rayfield

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Filter Type: 0.45  $\mu$ m, 25 mm, MEC  
Number of Grids Examined: 2  
Average Grid Square Area: 0.0088 mm<sup>2</sup>  
Sample Volume: 1449.0 liters  
EPA Analysis: AHERA

Filter Area: 385 mm<sup>2</sup>  
Number of Grid Squares Examined: 10  
Total Area Examined: 0.0880 mm<sup>2</sup>  
Detection Limit: 0.003 fibers/cc  
Grid Archive No.: 0219-E-3,4

ANALYTICAL RESULTS

	<u>Chrysotile</u>		<u>Amphiboles</u>		<u>Ambiguous</u>	<u>Non-Asbestos</u>
	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>	<u>&lt;5<math>\mu</math>m</u>	<u><math>\geq</math>5<math>\mu</math>m</u>		
Number of Fibers Analyzed:	0	0	0	0	0	1
Number of Bundles Analyzed:	0	0	0	0	0	0
Number of Clusters Analyzed:	0	0	0	0	0	0
Number of Matrices Analyzed:	0	0	0	0	0	0

SUMMARY

Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/cc)  
Concentration of Asbestos Structures < 5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Concentration of Asbestos Structures  $\geq$  5 $\mu$ m in length: ND (structures/mm<sup>2</sup>)  
Total Concentration of Asbestos Structures ND (structures/cc)  
Total Concentration of Asbestos Structures ND (structures/mm<sup>2</sup>)

Comments:

Barry Rayfield  
(Approved for Transmittal)

April 23, 1990  
(Date)

This test report relates only to the specific items tested.



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1635 PUMPHREY AVE  
AUBURN, AL 36830  
PHONE: (205) 826-6100  
FAX: (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-A

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: WG482

Received by: Barry Rayfield  
Analyzed by: Barry Rayfield

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Sample Type: DUST WIPE

QUALITATIVE ANALYSIS

A generous loading of dust was collected on a pre-wetted, 25 square centimeter section of a cleanroom wipe. The wipe was placed in a two ounce wide mouth collection vial and returned to the laboratory. Ten to fifteen milliliters of 0.2 micrometer filtered, deionized water was added to suspend the dust. The suspension was ultrasonically dispersed and the coarse fraction was allowed to settle. A drop of the suspension was placed on a Formvar coated 200 mesh Cu TEM grid and allowed to dry. The grid was carbon coated for thermal stability in the electron beam and examined by transmission electron microscopy at 120 kilovolts accelerating voltage.

RESULTS

Chrysotile structures were detected. An electron diffraction pattern (B759), electron micrograph (B760), and energy dispersive spectrum (WG482.eds) were recorded.

  
(Approved for Transmittal)

April 30, 1990  
(Date)

This test report relates only to the specific items tested.



ROY F. WESTON, INC.  
1635 PUMPHREY AVE.  
AUBURN, AL 36830  
PHONE: (205) 826-6100  
FAX: (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-B

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: WG483

Received by: Barry Rayfield  
Analyzed by: Beth Hiltbold

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Sample Type: DUST WIPE

QUALITATIVE ANALYSIS

A generous loading of dust was collected on a pre-wetted, 25 square centimeter section of a cleanroom wipe. The wipe was placed in a two ounce wide mouth collection vial and returned to the laboratory. Ten to fifteen milliliters of 0.2 micrometer filtered, deionized water was added to suspend the dust. The suspension was ultrasonically dispersed and the coarse fraction was allowed to settle. A drop of the suspension was placed on a Formvar coated 200 mesh Cu TEM grid and allowed to dry. The grid was carbon coated for thermal stability in the electron beam and examined by transmission electron microscopy at 120 kilovolts accelerating voltage.

RESULTS

Chrysotile structures were detected. An energy dispersive spectrum (WG483.eds) was recorded.

  
(Approved for Transmittal)

April 30, 1990  
(Date)

This test report relates only to the specific items tested.



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1635 PUMPHREY AVE  
AUBURN, AL 36830  
PHONE (205) 826-6100  
FAX (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-C

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: WG484

Received by: Barry Rayfield  
Analyzed by: Beth Hiltbold

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Sample Type: DUST WIPE

QUALITATIVE ANALYSIS

A generous loading of dust was collected on a pre-wetted, 25 square centimeter section of a cleanroom wipe. The wipe was placed in a two ounce wide mouth collection vial and returned to the laboratory. Ten to fifteen milliliters of 0.2 micrometer filtered, deionized water was added to suspend the dust. The suspension was ultrasonically dispersed and the coarse fraction was allowed to settle. A drop of the suspension was placed on a Formvar coated 200 mesh Cu TEM grid and allowed to dry. The grid was carbon coated for thermal stability in the electron beam and examined by transmission electron microscopy at 120 kilovolts accelerating voltage.

RESULTS

Chrysotile asbestos was detected. An energy dispersive spectrum (WG484.eds) was recorded.

Barry Rayfield  
(Approved for Transmittal)

April 30, 1990  
(Date)

This test report relates only to the specific items tested.



ROY F WESTON, INC.  
1635 PUMPHREY AVE.  
AUBURN, AL 36830  
PHONE: (205) 826-6100  
FAX: (205) 826-8232

TRANSMISSION ELECTRON MICROSCOPY  
ASBESTOS ANALYSIS REPORT

Client: ARGONNE  
Client Sample ID: M-18-D

Weston W.O. No.: 2104-13-02-0000  
Weston Sample ID No.: WG485

Received by: Barry Rayfield  
Analyzed by: Beth Hiltbold

Date Received: 04/13/90  
Date Analyzed: 04/16/90

Sample Type: DUST WIPE

QUALITATIVE ANALYSIS

A generous loading of dust was collected on a pre-wetted, 25 square centimeter section of a cleanroom wipe. The wipe was placed in a two ounce wide mouth collection vial and returned to the laboratory. Ten to fifteen milliliters of 0.2 micrometer filtered, deionized water was added to suspend the dust. The suspension was ultrasonically dispersed and the coarse fraction was allowed to settle. A drop of the suspension was placed on a Formvar coated 200 mesh Cu TEM grid and allowed to dry. The grid was carbon coated for thermal stability in the electron beam and examined by transmission electron microscopy at 120 kilovolts accelerating voltage.

RESULTS

Chrysotile asbestos was detected. An energy dispersive spectrum (WG485.eds) was recorded.

  
(Approved for Transmittal)

April 30, 1990  
(Date)

This test report relates only to the specific items tested.